

### **REMARKS**

This paper responds to the Office Action mailed on December 28, 2005.

Claims 1 and 31 are amended, no claims are canceled, and no claims are added, claims 2-4, 13, 16, 23-30 and 34-37 stand withdrawn, claims 38-66 were previously cancelled; as a result, claims 1-37 are now pending in this application.

#### **§112 Rejection of the Claims**

Claims 1 and 31 were rejected under 35 U.S.C. § 112, first paragraph, because the specification, while being enabling for thermal processing in the presence of a composition as described on instant page 16, lines 1-10, does not reasonably provide enablement for recitation of under conditions that reduce redeposition of the metal film broadly. Applicant has amended claims 1 and 31 to recite similar language to that used in the specification at least on page 16. In view of the claim amendment, Applicant respectfully requests that this rejection be withdrawn.

#### **§102 Rejection of the Claims**

Claim 1 was rejected under 35 U.S.C. § 102(a) for anticipation by Pan et al. (U.S. 6,198,144). Applicant respectfully traverses the rejection.

Pan discloses a method of forming protective sidewalls of a word stack line. The passivation comprises the formation of a silicon nitride sidewall layer 22 by CVD that is formed over a CVD or sputtered oxide layer 20 (see col. 4, line 41 to col. 5, line 35) that prevents the spacer 22 from covering the entire sidewall. This is done for two reasons. The first is to increase the oxidation of the corner of the stack to substrate intersection, as shown in Figure 5, and discussed in the cited reference starting at col. 5, line 59. The second is for “preventing or reducing the conversion of those layers to non-conductive compounds during the reoxidation process”, referring to the previously mentioned “metal layers of the word line stack”.

Applicant respectfully disagrees with the statement on page 3 of the outstanding Office Action that since the “oxidant penetrated material 20 to oxidize the corner of the source/drain regions and therefore penetrates to the gate stack”, and therefore is “thus reducing redeposition”. Applicant reiterates that the cited reference prevents oxidation of the metal 13 and barrier metal 12, and thus there is nothing to prevent redeposition at the expense of using a sidewall

comprising an oxide layer 20 and a nitride layer 22. By contrast and by way of example only, Applicant's disclosure recites a method of treating the sidewalls 26 and 28 of the gate stack (see Fig. 5 and page 12) by means of "selective steam" prior to forming the spacers 36 by means of ordinary deposition and anisotropic etch. Thus, Applicant restates that the cited reference of Pan is not even using the same arrangement, is doing something different, using different materials. Pan is forming two part sidewall spacers to allow for proper oxidation at the gate stack corners, while an embodiment of the present disclosure is oxidizing the entire sidewall of the gate stack prior to forming the sidewall spacers. Since the present disclosure is oxidizing the sidewalls 26 and 28 of the gate stack prior to forming the spacers 36, there is a potential issue that does not occur in the totally different structure of the cited reference of Pan, namely the potential redeposition of oxidized metal from layer 20 onto the substrate. Such an issue is not discussed in Pan since it does not exist in the totally different structure of Pan.

Specifically, Applicant respectfully submits that the Pan reference does not disclose at least "...*patterning the metal film, barrier layer and polysilicon layer to form a patterned gate stack; and oxidizing the patterned gate stack ...*", as recited in claim 1, as amended herein. Pan does not oxidize the patterned gate stack, just the lower corner of the gate oxide 16 to poly 11 interface. In view of the above amended claim, Applicant respectfully requests that this rejection be reconsidered and withdrawn.

### §103 Rejection of the Claims

Claims 1, 5, 6, 9-12, 14 and 15 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of Applicants' admitted prior art (AAPA), Mitani et al. (U.S. 6,191,463) and Pan et al. (U.S. 6,198,144). Applicant respectfully traverses the rejection.

The cited reference of Pan has features that have been discussed above. Mitani discloses a simple polysilicon gate electrode over a gate dielectric, with no suggestion of a gate stack having metal layers or polycide layers. Mitani discloses exposing the polysilicon film 222 to oxygen and  $\text{NF}_3$  at about 1 Torr pressure at about 800° C (col. 41, lines 14-16).

Applicant respectfully submits Mitani suggests that the purpose of the  $\text{NF}_3$  atmosphere is "to obtain a desired doping profile in the channel region including a profile in which the F concentration near the edges of the channel region is higher than that in the middle of the

channel region” (see col. 42, line 4), which is a different process, under different conditions, with a totally different structure, and a different outcome. The Mitani reference does not have metal layers that would contaminate the substrate if oxidized.

Thus, Applicant respectfully submits that the suggested combination would result in a non-functional device since the metal layer of the AAPA would either evaporate or oxidize and destroy the device or contaminate the device if the Mitani reference were to be combined with the AAPA. Thus, the suggested combination fails to meet the requirement that if the proposed modification results in an arrangement that is unsatisfactory for its intended purpose, then there can be no motivation to make the proposed combination. (See *In re Gordon*). Thus, Applicant submits that the suggested combination of references is inappropriate, and even if it were appropriate, still would not result in all of the claimed features of the present application. In view of the above discussion, Applicant respectfully requests that this rejection be reconsidered and withdrawn.

Claims 17 and 18-22 were rejected under 35 U.S.C. § 103(a) as being unpatentable over (AAPA) in combination with Mitani et al. and Pan et al. as applied to claims 1, 5, 6, 9-12, 14 and 15 above, and further in view of Cunningham (U.S. 6,479,362). Applicant respectfully traverses this rejection.

The cited references of Mitani, the AAPA and Pan have features that have been discussed above. The Cunningham reference is used in the Office Action to show that it is known to form sidewalls after polycide formation.

Applicant submits that whether or not Cunningham is an appropriate reference to combine with the other references, Cunningham does nothing to cure the failure of Mitani and Pan to describe or suggest at least the claimed feature of “...*forming a metal film over a structure; and thermally processing the structure in the presence of a first composition such that the metal is more likely to combine with at least a portion of the first composition than with the structure...*”, as recited in claim 9, with similar language in claim 18, from which claims 17 and 19-22 depend.

Applicant submits that there is nothing in the cited references about thermally processing a metal film such that the metal does not redeposit on the structure. Applicant respectfully requests that this rejection be reconsidered and withdrawn.

Claim 31 was rejected under 35 U.S.C. § 103(a) as being unpatentable over AAPA in combination with Mitani et al. and Pan et al. as applied to claims 1, 5, 6, 9-12, 14, and 15 above, and further in view of Jain et al. (U.S. 6,613,682) and Zietlow (U.S. 4,748,131). Applicant respectfully traverses the rejection.

The cited references of Mitani and Pan have features that have been discussed above. The Jain reference is used in the Office Action to show forming polycide gate electrodes using  $\text{NF}_3$  gas. Jain discloses a method of removing a dielectric antireflective coating during a gate etch process, and does not appear to have any suggestion of a metal layer in the gate stack or of oxidizing an exposed metal layer, and is thus not an appropriate reference.

The cited reference of Zietlow is used in the Office Action to show the use of  $\text{NF}_3$  gas in a gate oxidation formation process, and for incorporating F in the gate oxide. Zietlow permanently embeds fluorine atoms in the gate oxide to reduce radiation induced interface state density. There appears to be no suggestion in Zietlow of the use of fluorine to prevent redeposition of the nonexistent metal gate layer during a gate oxidation operation, and is thus not an appropriate reference for combination with other references since it provides no motivation to make the combination.

Applicant submits that the suggested combination of references fails to describe or suggest at least the claimed feature of “...*forming a spacer layer over the gate stack under conditions providing at least one of a halogen and a material having a thermodynamic advantage over the substrate in volatilizing the metal film that reduce redeposition on the substrate and the gate stack of a volatilized portion of the metal film...*”, as recited in claim 31, as amended herein.

Applicant submits that there is nothing in the cited references about thermally processing a metal film such that the metal does not redeposit on the structure. Applicant respectfully requests that this rejection be reconsidered and withdrawn.

*Allowable Subject Matter*

Claims 32 and 33 were objected to as being dependent upon a rejected base claim, but were indicated to be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Applicant thanks the Examiner for the indication of patentable subject matter. Applicant rewrites claims 32 and 33 into independent form. These rewrites do not narrow the scope of the claims and are merely directed to form of the claims.

**CONCLUSION**

Applicant respectfully submits that the claims are in condition for allowance, and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney David Suhl at (508) 865-8211, or the undersigned attorney at (612) 349-9587 to facilitate prosecution of this application. If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

FERNANDO GONZALEZ ET AL.

By their Representatives,

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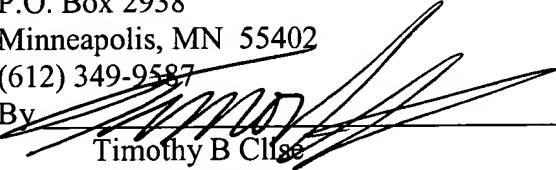
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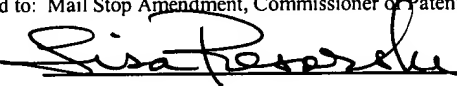
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